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ON THE COAGULATION OF THE BLOOD.

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The following communication is a continuation of the results already published by myself as to the influence of lecithin in producing coagulation of the blood[1].

The plasma used in those experiments was peptone plasma. In the present case I have made use of blood which has been prevented from coagulating by being, immediately after leaving the body, cooled down to a temperature of about 0^0.

For experiments on cooled plasma it is best to use the blood of the horse. I was however unable to obtain any horse's blood and therefore employed dog's blood. In horse's blood the corpuscles sink rapidly and the coagulation is very tardy, it is hence easy to obtain plasma. This is not the case with the dog, and I was therefore led to adopt a particular method of experimenting.

The coagulation of the blood is brought about by a certain interaction of the white corpuscles and the plasma. By rapid cooling this interaction is to a great extent suppressed and hence the blood does not coagulate. But if one of the substances of which the white cells are made up be diffused through the cooled blood, coagulation does occur. This substance is lecithin.

The method of experimenting is as follows. The blood is taken from a large artery and flows into a thin cylindrical metal vessel of about $\frac{1}{2}$-inch diameter. This tube stands in a large vessel filled with broken ice and a small quantity of water to fill up the interspaces.

For each experiment two such tubes are used. Each holds 40 c.c. In the one is contained 15 c.c. of ·6 per cent. NaCl solution, in the other a similar quantity of normal salt solution through which finely emulsified lecithin is diffused.

The blood flows directly from the artery into the metal vessels, one

[1] "Further Observations on the Coagulation of Blood." *Journal of Physiology*, Vol. IV. Nos. 2 & 3. "Zur Gerinnung des Blutes." *Archiv für Anat. u. Physiol.* 1883.

vessel being filled immediately after the other. Absolutely no interruption to the flow must occur. The first small quantity of blood is not used.

The following examples will shew clearly the nature of the results.

I. Large Dog. Blood from Femoral.

Tube 1 contains lecithin.

Tube 2 contains simple salt solution.

By means of glass rod mixing is carried out in each tube, a separate rod being used for each tube.

Tubes filled at 4.15 P.M.

At 4h. 45m., as is ascertained by feeling with glass rod in tube 1 (lecithin), the blood is firmly coagulated.

At this time the blood in tube 2 is perfectly fluid. The temperature in the two tubes is the same, 2° at upper, 3° at lower part of tube.

On removing tube 1 from ice and inverting, a solid clot, forming a complete cast of the tube, slips out.

At 5h. 30m., blood in tube 2, on trying with glass rod is evidently completely fluid; on taking it out of ice and inverting the blood flows out; it is perfectly free from coagula; there are no traces of coagula on the walls of the tube.

II. Similar arrangements as in I. Large Dog. Blood from Carotid.

Tube 1, lecithin.

Tube 2, simple salt solution.

Tubes filled at 4h. 3m. P.M.

At 4h. 10m. tube 1 completely coagulated.

„ tube 2 completely fluid.

Temperature in the two tubes equal, 2·5° in middle of tube.

At 4h. 45m. tube 2 still quite fluid.

At 5h. imperfectly coagulated.

III. Arrangement the same. The lecithin is badly emulsified and in flocculent pieces which tend to rise to the surface of the NaCl solution.

Time of filling the two tubes 4.50 P.M.

At 5.30 P.M., tube 1 (lecithin), several loose coagula can be fished out. Tube 2 apparently quite free. Temp. tube 1, 2·5° bottom, 1·5° top.

„ tube 2, 4° bottom, $2\frac{1}{2}$° top.

On emptying tube 1 it is found to contain loose clots and fluid blood, it is coagulated firmly at the top so that it can be inverted. The walls of the tube covered with clot.

At 6 P.M. tube 2 emptied. The contained blood is perfectly fluid. No trace of coagulation on the walls of the tube.

I have made many such experiments and always with the like result. That is to say, the addition of lecithin causes coagulation.

The lecithin used is prepared from lymph-glands in the manner I have described in the above-quoted papers. It has a slightly acid reaction and is not perfectly pure. It is rubbed up with a drop or two of dilute Na_2Co_3 solution to a paste and this is diffused through the salt solution. The salt solution after the addition of the lecithin is either neutral or very faintly alkaline. It should be an emulsion as opaque as milk if the coagulation is to occur quickly.

In my experiments on peptone plasma I have shewn that the small quantities of impurities contained in the lecithin preparations are of no effect in producing coagulation and also that lecithin from other sources is active, and hence I have felt justified in speaking of the alcohol-ether extract of the glands as lecithin, though it is not perfectly pure. From its mode of preparation it is evident that this extract cannot contain any paraglobulin.

In discussing the results I have obtained on peptone plasma with friends whose opinions are of worth, there has always been a tendency to suppose that the results obtained are due to presence of fibrin ferment in the lecithin preparations. In fact this is, so far as I can see, the only objection one can raise. It is however certainly not a valid objection. The lecithin is not influenced in its activity by being boiled with water. I have tried this several times both with peptone and cooled blood, and as a matter of fact it has no fermentative activity.

There are many coagulable fluids which do not coagulate in the slightest on the addition of lecithin but do so readily with fibrin ferment, although the lecithin in question acts perfectly with plasma. Such fluids are human pericardial fluid, hydrocele fluid so far as I have examined, and solution of fibrinogen prepared according to the salt method from peptone plasma.

The experiments described were carried out in the Pathological Institute in Berlin. I am much indebted to Prof. Salkowski for the use of his Laboratory.

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